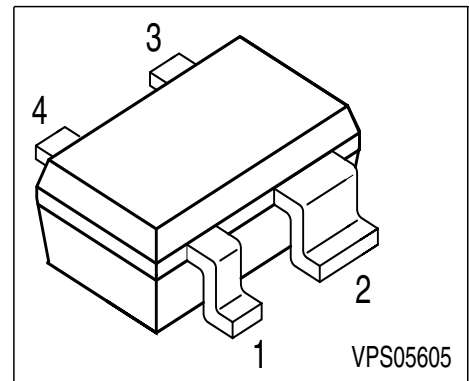


## NPN Silicon RF Transistor

- For highest gain low noise amplifier at 1.8 GHz
- Outstanding  $G_{ms} = 21$  dB  
Noise Figure  $F = 0.9$  dB
- Gold metallization for high reliability
- SIEGET 45 - Line



**ESD:** Electrostatic discharge sensitive device, observe handling precaution!

Type	Marking	Pin Configuration						Package
BFP540	ATs	1=B	2=E	3=C	4=E	-	-	SOT343

### Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	$V_{CEO}$	4.5	V
Collector-emitter voltage	$V_{CES}$	14	
Collector-base voltage	$V_{CBO}$	14	
Emitter-base voltage	$V_{EBO}$	1	
Collector current	$I_C$	80	mA
Base current	$I_B$	8	
Total power dissipation <sup>1)</sup> $T_S \leq 77^\circ\text{C}$	$P_{tot}$	250	mW
Junction temperature	$T_j$	150	$^\circ\text{C}$
Ambient temperature	$T_A$	-65 ... 150	
Storage temperature	$T_{stg}$	-65 ... 150	

### Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point <sup>2)</sup>	$R_{thJS}$	$\leq 290$	K/W

<sup>1)</sup>  $T_S$  is measured on the collector lead at the soldering point to the pcb

<sup>2)</sup> For calculation of  $R_{thJA}$  please refer to Application Note Thermal Resistance

**Electrical Characteristics** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage $I_C = 1\text{ mA}, I_B = 0$	$V_{(BR)CEO}$	4.5	5	-	V
Collector-emitter cutoff current $V_{CE} = 14\text{ V}, V_{BE} = 0$	$I_{CES}$	-	-	10	$\mu\text{A}$
Collector-base cutoff current $V_{CB} = 5\text{ V}, I_E = 0$	$I_{CBO}$	-	-	100	nA
Emitter-base cutoff current $V_{EB} = 0.5\text{ V}, I_C = 0$	$I_{EBO}$	-	-	10	$\mu\text{A}$
DC current gain $I_C = 20\text{ mA}, V_{CE} = 3.5\text{ V}$	$h_{FE}$	50	110	200	-

**Electrical Characteristics at  $T_A = 25^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics (verified by random sampling)					
Transition frequency $I_C = 50\text{ mA}$ , $V_{CE} = 4\text{ V}$ , $f = 1\text{ GHz}$	$f_T$	21	30	-	GHz
Collector-base capacitance $V_{CB} = 2\text{ V}$ , $f = 1\text{ MHz}$	$C_{cb}$	-	0.14	0.24	pF
Collector emitter capacitance $V_{CE} = 2\text{ V}$ , $f = 1\text{ MHz}$	$C_{ce}$	-	0.33	-	
Emitter-base capacitance $V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$	$C_{eb}$	-	0.65	-	
Noise figure $I_C = 5\text{ mA}$ , $V_{CE} = 2\text{ V}$ , $f = 1.8\text{ GHz}$ , $Z_S = Z_{Sopt}$ $I_C = 5\text{ mA}$ , $V_{CE} = 2\text{ V}$ , $f = 3\text{ GHz}$ , $Z_S = Z_{Sopt}$	$F$	- -	0.9 1.3	1.4 -	dB
Power gain, maximum stable <sup>1)</sup> $I_C = 20\text{ mA}$ , $V_{CE} = 2\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 1.8\text{ GHz}$	$G_{ms}$	-	21.5	-	dB
Power gain, maximum available <sup>1)</sup> $I_C = 20\text{ mA}$ , $V_{CE} = 2\text{ V}$ , $Z_S = Z_{Sopt}$ , $Z_L = Z_{Lopt}$ , $f = 3\text{ GHz}$	$G_{ma}$	-	16	-	dB
Transducer gain $I_C = 20\text{ mA}$ , $V_{CE} = 2\text{ V}$ , $Z_S = Z_L = 50\text{ }\Omega$ , $f = 1.8\text{ GHz}$ $I_C = 20\text{ mA}$ , $V_{CE} = 2\text{ V}$ , $Z_S = Z_L = 50\text{ }\Omega$ , $f = 3\text{ GHz}$	$ S_{21e} ^2$	16 -	18.5 14.5	- -	dB
Third order intercept point at output <sup>2)</sup> $V_{CE} = 2\text{ V}$ , $I_C = 20\text{ mA}$ , $f = 1.8\text{ GHz}$ , $Z_S = Z_L = 50\text{ }\Omega$	$IP_3$	-	24.5	-	dBm
1dB Compression point at output $I_C = 20\text{ mA}$ , $V_{CE} = 2\text{ V}$ , $Z_S = Z_L = 50\text{ }\Omega$ , $f = 1.8\text{ GHz}$	$P_{-1dB}$	-	11	-	

<sup>1)</sup>  $G_{ma} = |S_{21e} / S_{12e}| (k - (k^2 - 1)^{1/2})$ ,  $G_{ms} = |S_{21e} / S_{12e}|$

<sup>2)</sup>  $IP_3$  value depends on termination of all intermodulation frequency components.  
Termination used for this measurement is  $50\ \Omega$  from 0.1 MHz to 6 GHz

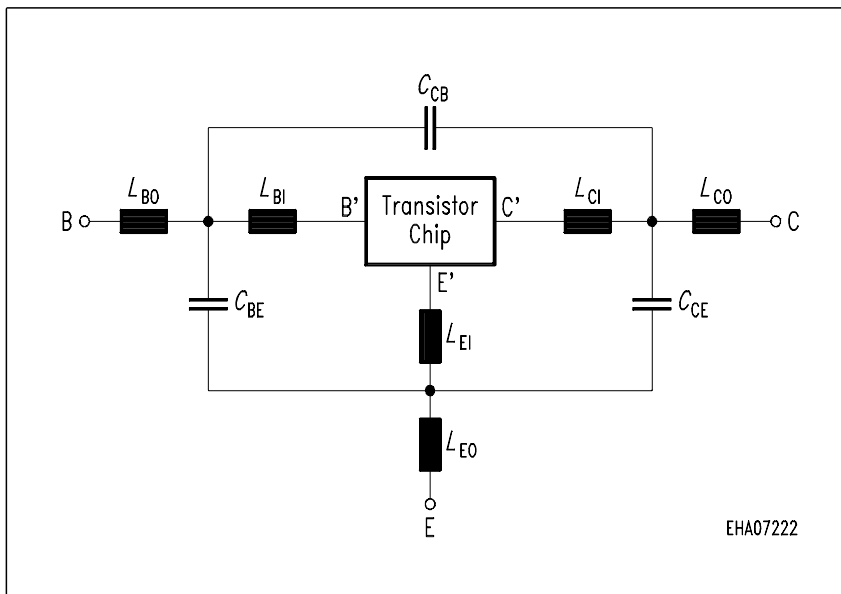
## SPICE Parameter (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax):

### Transistor Chip Data:

IS =	82.84	aA	BF =	107.5	-	NF =	1	-
VAF =	28.383	V	IKF =	0.48731	A	ISE =	11.15	fA
NE =	3.19	-	BR =	5.5	-	NR =	1	-
VAR =	19.705	V	IKR =	0.02	A	ISC =	19.237	aA
NC =	1.172	-	RB =	5.4	$\Omega$	IRB =	0.72983	mA
RBM =	1.3	$\Omega$	RE =	0.31111	-	RC =	4	$\Omega$
CJE =	1.8063	fF	VJE =	0.8051	V	MJE =	0.46576	-
TF =	6.76	ps	XTF =	0.4219	-	VTF =	0.23794	V
ITF =	1	mA	PTF =	0	deg	CJC =	234	fF
VJC =	0.81969	V	MJC =	0.30232	-	XCJC =	0.3	-
TR =	2.324	ns	CJS =	0	fF	VJS =	0.75	V
MJS =	0	-	XTB =	0	-	EG =	1.11	eV
XTI =	3	-	FC =	0.73234		TNOM	300	K

All parameters are ready to use, no scaling is necessary.

### Package Equivalent Circuit:



$L_{BI}$ =	0.47	nH
$L_{BO}$ =	0.53	nH
$L_{EI}$ =	0.23	nH
$L_{EO}$ =	0.05	nH
$L_{CI}$ =	0.56	pH
$L_{EO}$ =	0.58	nH
$C_{BE}$ =	136	fF
$C_{CB}$ =	6.9	fF
$C_{CE}$ =	134	fF

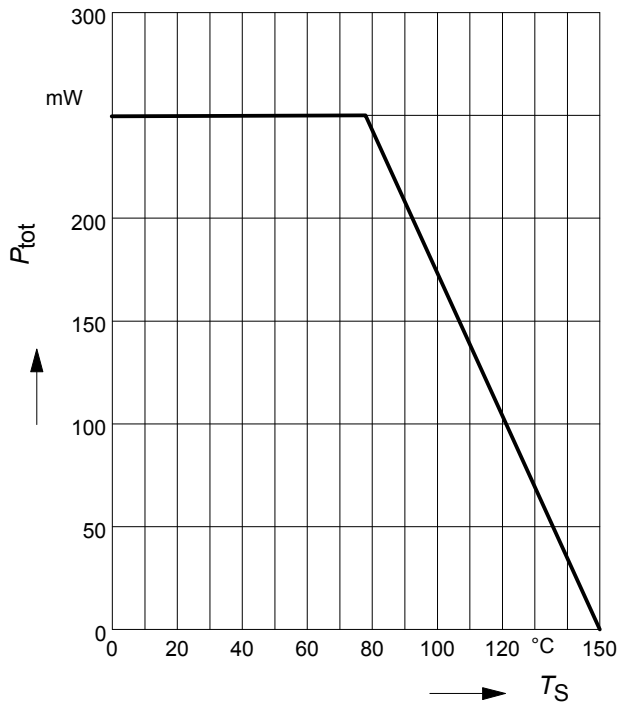
Valid up to 6GHz

For examples and ready to use parameters please contact your local Infineon Technologies distributor or sales office to obtain a Infineon Technologies CD-ROM or see Internet: <http://www.infineon.com/silicondiscretes>

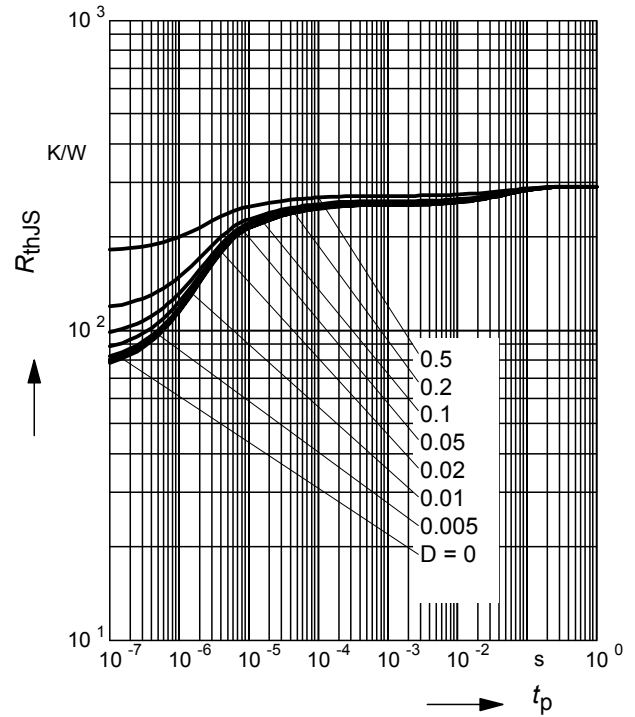
### For non-linear simulation:

- Use transistor chip parameters in Berkeley SPICE 2G.6 syntax for all simulators.
- Simulation of the package is not necessary for frequencies < 100MHz.  
For higher frequencies please add the wiring of the package equivalent circuit around the non-linear transistor.

**Total power dissipation  $P_{\text{tot}} = f(T_S)$**

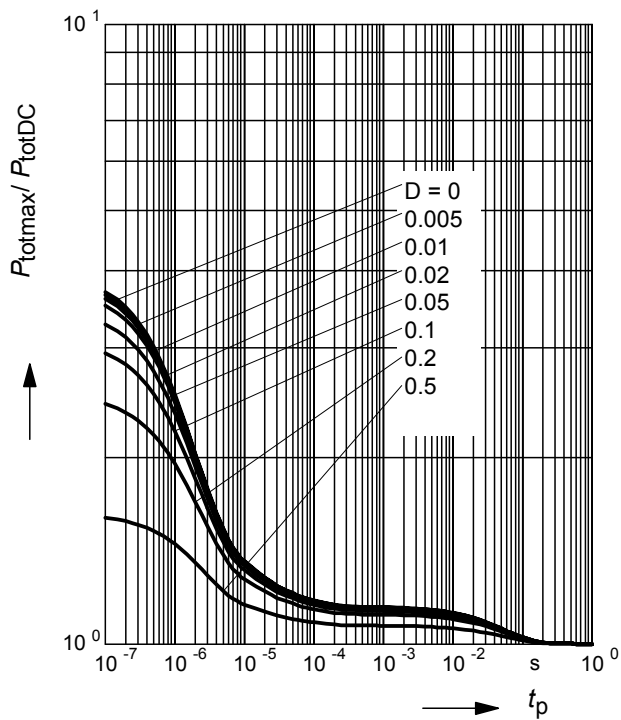


**Permissible Pulse Load  $R_{\text{thJS}} = f(t_p)$**



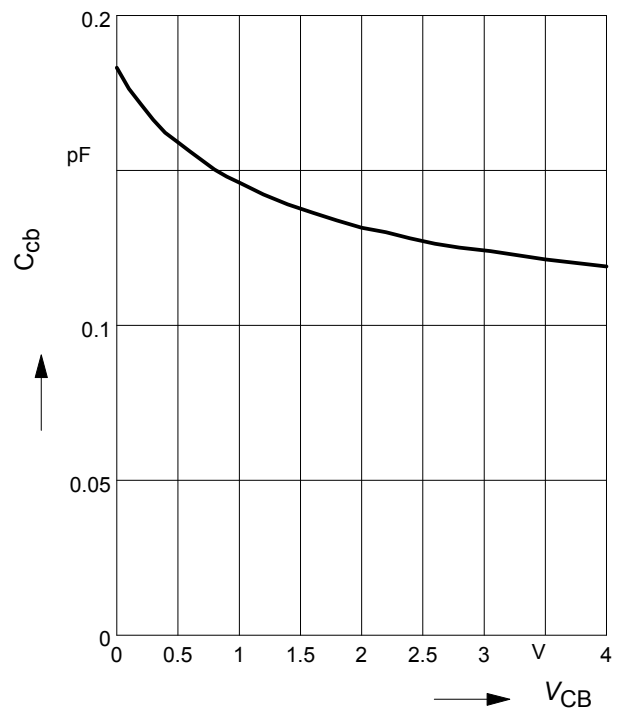
**Permissible Pulse Load**

$P_{\text{totmax}}/P_{\text{totDC}} = f(t_p)$



**Collector-base capacitance  $C_{\text{cb}} = f(V_{\text{CB}})$**

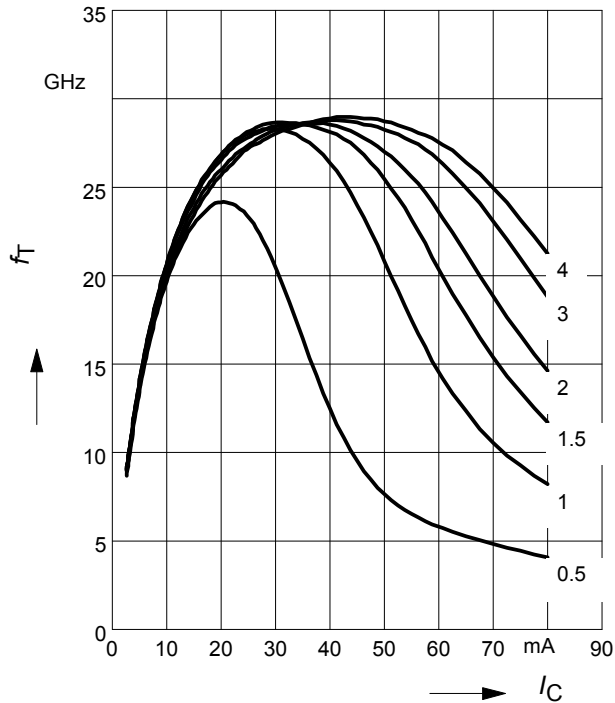
$f = 1\text{MHz}$



**Transition frequency  $f_T = f(I_C)$**

$f = 1\text{GHz}$

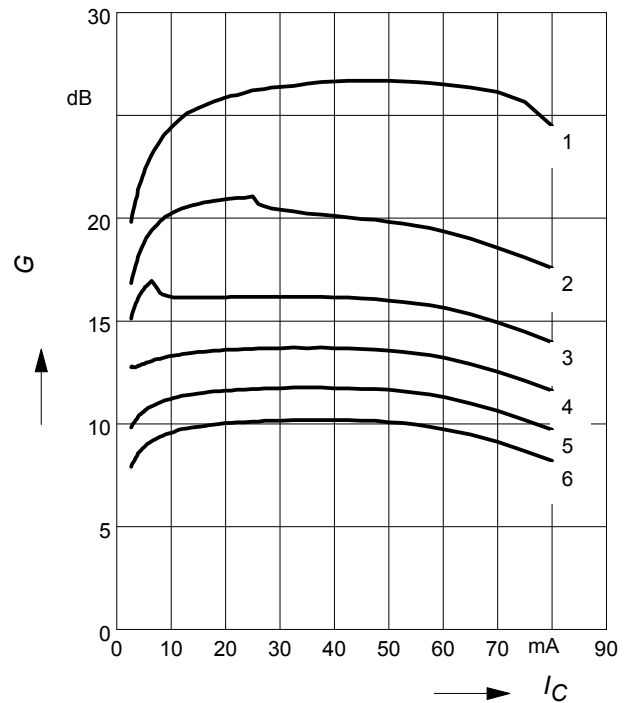
$V_{CE} = \text{Parameter in V}$



**Power gain  $G_{ma}, G_{ms} = f(I_C)$**

$V_{CE} = 2\text{V}$

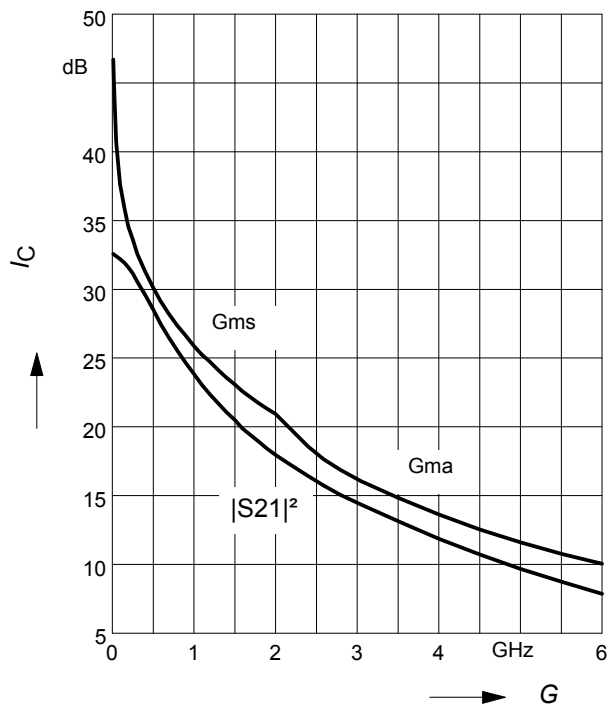
$f = \text{Parameter in GHz}$



**Power Gain  $G_{ma}, G_{ms} = f(f)$ ,**

$|S_{21}|^2 = f(f)$

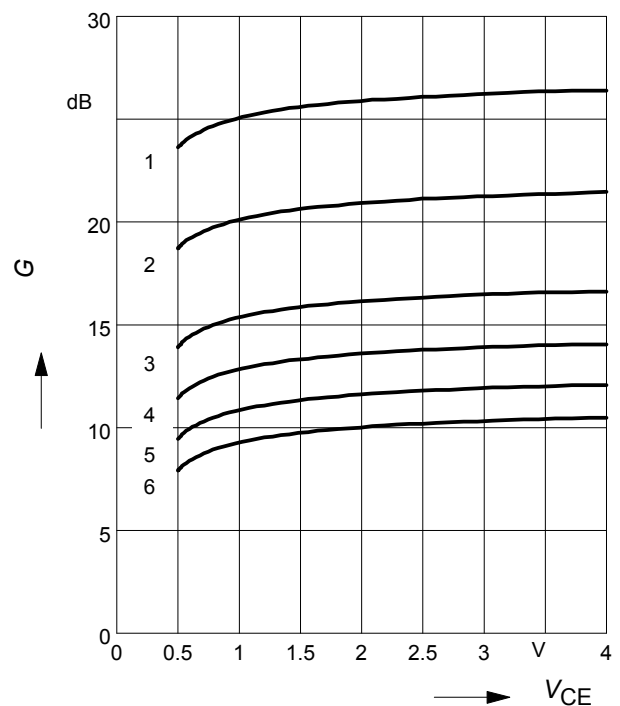
$V_{CE} = 2\text{V}, I_C = 20\text{mA}$



**Power gain  $G_{ma}, G_{ms} = f(V_{CE})$**

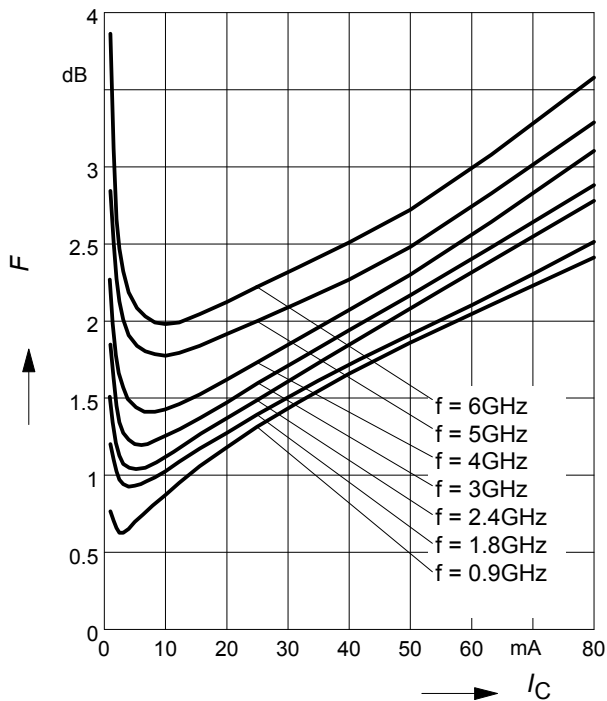
$I_C = 20\text{mA}$

$f = \text{Parameter in GHz}$



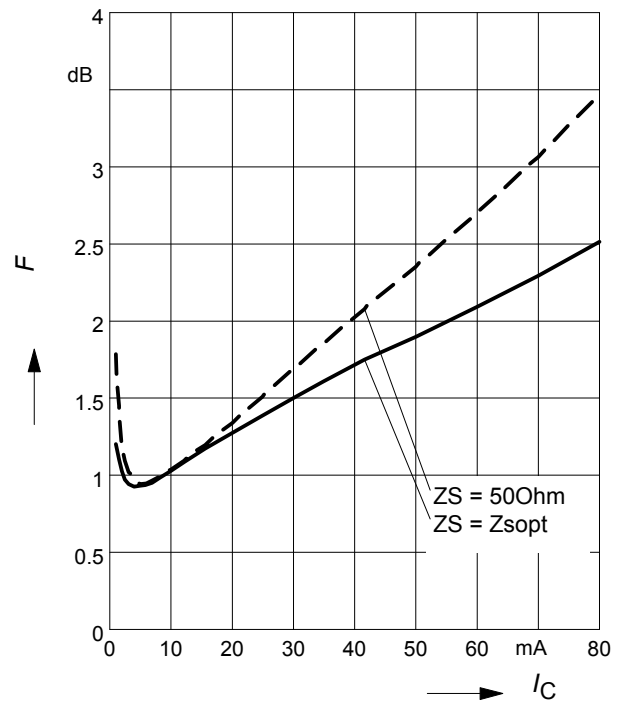
**Noise figure  $F = f(I_C)$**

$V_{CE} = 2V, Z_S = Z_{Sopt}$



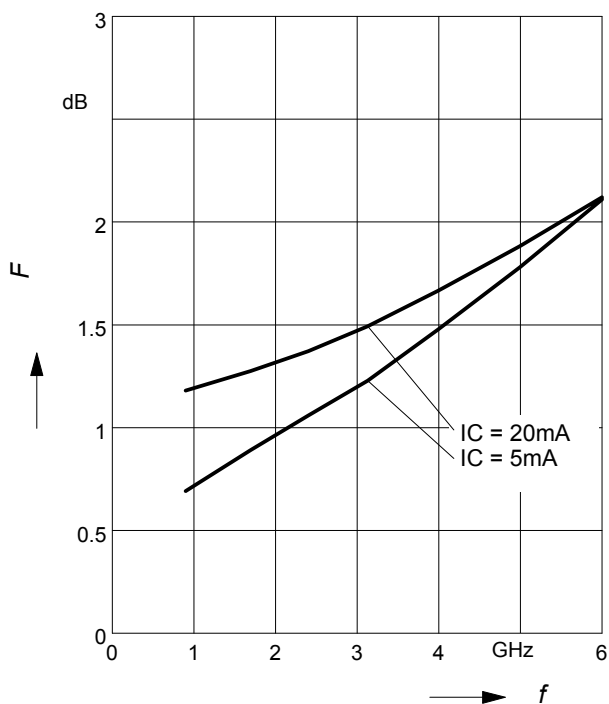
**Noise figure  $F = f(I_C)$**

$V_{CE} = 2V, f = 1.8\text{GHz}$



**Noise figure  $F = f(f)$**

$V_{CE} = 2V, Z_S = Z_{Sopt}$



**Source impedance for min.**

**noise figure vs. frequency**

$V_{CE} = 2V, I_C = 5\text{mA} / 20\text{mA}$

